1. A method for encrypting programs for encrypted execution on a network having a remote host computer, comprising the steps of:

encoding a program as a unitary matrix with n rows and n columns;

encoding an input data string to the program as a vector of length n, wherein execution of the program on the input data string is realized by matrix multiplication of the unitary matrix with the vector;

loading the encoded program and the encoded data string on the host computer;

executing the encoded program, using the encoded data string, on the host computer;

communicating results from the host computer to the network; and

decoding the results into output representative of executing the program with the data string, wherein computations and data associated with the program and data string are unintelligible and useless at the host computer.

2. A method of claim 1, wherein the step of encoding a program comprises converting the program to a unitary matrix multiplication.

3. A method of claim 2, wherein the step of converting the program comprises converting the program to a unitary matrix multiplication U such that $U \in U_n$ for some integer n, where U_n represents a group of unitary matrices of size n.

4. A method of claim 3, wherein the step of encoding the program comprises generating two independent identically distributed unitary matrices X, Y from the uniform probability distribution over U_n determined by the Haar distribution.

5. A method of claim 4, wherein the step of encoding a program comprises the steps of computing U' as XUY* and communicating U' to the remote host computer over the network.

6. A method of claim 4, wherein the step of encoding the input data string comprises converting the input data string to a vector b.

7. A method of claim 6, wherein the step of encoding comprises the steps of computing b' as Yb and communicating b' to the remote host over the network.

8. A method of claim 7, wherein the step of executing the encoded program, using the encoded data string, on the host computer comprises the steps of computing the product of XUY* and Yb and communicating results to the network.

9. A method of claim 1, wherein the step of decoding the results into output comprises computing X*XUb, external of the host computer, to determine the multiplication of Ub as desired output of the program.

10. A method of claim 1, wherein the step of decoding comprises decrypting at a control computer connected to the network and the host computer.

11. A method of claim 1, wherein the network comprises the Internet.

12. A method of claim 1, wherein the network comprises a virtual private network.

13. A method of claim 1, wherein the network comprises a local area network (LAN).

14. A method of claim 1, further comprising embedding one or more constants into the input data string or program, prior to encoding, to detect incorrect execution or data tampering.

15. A secured network for executing encrypted computer programs at a remote host computer without sharing intelligible or otherwise useful program code, computations or data associated with execution, comprising:

a control computer for encoding a program as a unitary matrix with n rows and n columns and for encoding an input data string to the program as a vector of length n, wherein execution of the program on the input data string is realized by matrix multiplication of the unitary matrix with the vector; and

a host computer, in network with the control computer, for loading the encoded program and the encoded data string, the host computer executing the enco connected to ded program, using the encoded data string, and communicating results to the control computer for decoding, the host computer having substantially no intelligible or otherwise useful program code, computations or data associated with execution of the program.

16. A network of claim 15, wherein the control computer embeds one or more constants into the unitary matrix or data string, wherein the results from the host computer indicate tampering or incorrect execution of the encoded program.